

# Technical Report

[US417] AS THE SHIP CAPTAIN I WANT THE TECHNICAL TEAM TO SEARCH FOR AT LEAST THREE TYPES OF SHIP/VESSELS THAT ARE BETTER SUITED TO THE TASK.

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## Introduction

In this report we are going to go through the necessary information to know when it comes to choosing the right ships for any fleet whose main objective is the transport of goods, primarily containers.

This report will talk about the different types of cargo that can be transported by ship but will mainly focus on the containers, since it is the primary type of cargo that our client wants to transport. Taking that in account, this report also goes over the different types of container ships and their purposes/characteristics and finally the different container ships that we recommend, comparing them with each other.

Our objective is that by the end of this report the reader will get a good idea of the different types of container ships and which ones are more suited for the task.

## Glossary

Name	Abbreviation	Description
Twenty-foot Equivalent Unit	TEU	Unit of cargo used in container ships based on the volume of the standardized 20-foot long intermodal container.
Length	-	Maximum length of a vessel's hull (measured parallel to the waterline).
Beam	-	Maximum width of a vessel's hull (measured at its widest point).
Draft (or Draught)	-	Vertical distance between the waterline and the bottom of the hull.
Bow	-	Forward part of the hull of a ship.
Stern	-	Rear part of the hull of a ship.
Deadweight	DWT	Measure of how much weight a ship can carry.
Lightweight	-	Weight of the ship with no fuel, passengers, cargo, water.
Length overall	L.O.A.	The maximum length of a vessel's hull measured parallel to the waterline.
Length Between Perpendiculars	L.P.P.	The length of a ship along the main bow perpendicular member, to the main stern perpendicular member.
Depth	-	The distance between the undersides of the deck amid ship to the bottom of the keel.

## Type of Cargo

In order to choose ships better suited to the task we opted to restrict our research to container ships which are cargo ships that carry all of its load in truck-size **intermodal containers**.

This decision was based mainly on compatibility with the project currently being developed, which deals only with ISO container cargo.

## Types of Container Ships

Container ships are categorized according to size into 3 main types: Ultra Large Container Vessel (the largest type), Panamax (medium range) and Feeder (the smallest type). Both Panamax and Feeders are divided into subcategories.

Category	Subcategory	Capacity (TEU)	Length	Beam	Draft
Ultra Large Container Vessel (ULCV)	-	14,501 and higher	366 m and longer	49 m and wider	15.2 m and deeper
Panamax	Neopanamax (or New Panamax)	10,001 – 14,500	Up to 366 m	Up to 49 m	Up to 15.2 m
	Post-Panamax	5,101 – 10,000			
	Panamax	3,001 – 5,100	Up to 294.13 m	Up to 32.31 m	Up to 12.04 m
Feeder	Feedermax	2,001 – 3,000			
	Feeder	1,001 – 2,000			
	Small feeder	Up to 1,000			

Table 1 - Container ship size categories [1]

### Ultra Large Container Vessel

The Ultra Large Container Vessels arise from the need to build ships in increasingly larger sizes, in order to profit from economies of scale and reduce expenses.

The number of vessels of this type is, however, limited since sea transportation is subject to limitations in size. The size of ports and terminals in which ships must dock, as well as the width and depth of water canals are constraints that make these types of ships economical but unable to travel certain routes.

### Panamax

Panamax is a term used to describe ships that have reached the maximum limit of size to be able to get through the Panama Canal up to 2016, when the canal size was increased.

Due to this increased size, bigger ships were built which had the name of “Post-Panamax” and “Neopanamax”. Post-Panamax is the name given to ships that do not fit in the original canal docks. Neopanamax is the name given to ships that were built taking in mind the new canal size. [2]

### Feeder

Feeder ships have as their main objective the transport of shipping containers from different ports to central container terminals or transshipment hubs where they are loaded to bigger vessels for further transport.

Feeder vessels can carry up to 3000 TEU, which means they can carry on average between 300 and 1000 containers. [3]

## The Control Tower/Bridge

The bridge is the main control center of a vessel, from where the captain and officers are able to man the entire operations of the vessel. It is generally located in a position with an unrestricted view and immediate access to the essential areas of a ship. [4]

On most container ships the bridge is located at the stern, but as ship sizes and capacity keeps on growing, the need arises to bring it closer to the front due to constraints in visibility.

For this reason, the bridge can be found at the stern on smaller/medium ships and at midship on larger vessels. This phenomenon also shows through in our range of chosen ships (further below). We do not find, however, sea container ships with bridges at the bow mostly because this area takes the most punishment than any area of the hull from the weather conditions and the heavy reinforcement needed for the bridge infrastructure would render it more expensive to build. [5]

## The Types of Ships we Chose and Why

We were asked to choose three different types of container ships and after our research we settled in these three types of ships:

- **Small Feeder** – Having a feeder is essential for any fleet as they help transport containers over small distances.
- **Panamax** – Having a container ship that can get through the Panama Canal is also a great addition for any fleet.
- **Ultra Large Container Vessel** – It is essential to have a big ship in any fleet, this helps with large quantities of cargo over large distances.

These ships were also chosen taking in mind that we wanted to have the widest range of ship sizes for it to be easier to compare them with each other, this also allows for the bridge to take different locations in the ships, since the bigger the ship the further forward the bridge is placed to have a clear vision.

Having such different ships also makes a big difference when it comes to the lightweights which will be useful for the calculations that will need to be done further in the project.

## The Ships we Chose

This topic will go over the different ships that we chose and their characteristics, however it is necessary to note that most ships do not contain information about their lightweight, which is mandatory information for this report, so it was necessary to find a way to get the lightweight using only the rest of the information given.

Luckily, we were able to infer a relation between the lightweight and the deadweight of a ship, since the infrastructure needed to support increasing weight must be increasingly heavy itself due to added reinforcements to support the pressure. Together with calculations performed on values we had

from a ship with deadweight and lightweight records, and comments from a Naval Architect stating that “a ship with 50,000 cargo deadweight, probably has a 15,000-ton light ship weight.” [6] we reached the approximation that in general a ship is able to carry (in deadweight) about 3.5 times its lightweight.

## ULCV - Maersk MC Kinney Moller

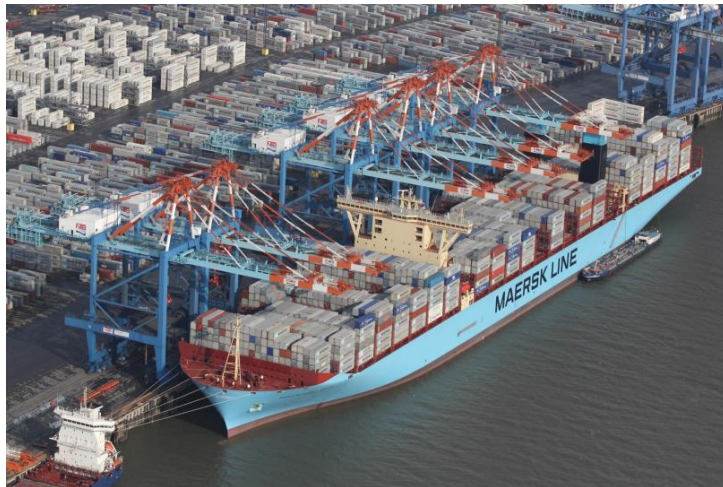


Figure 1 - MC Kinney Moller

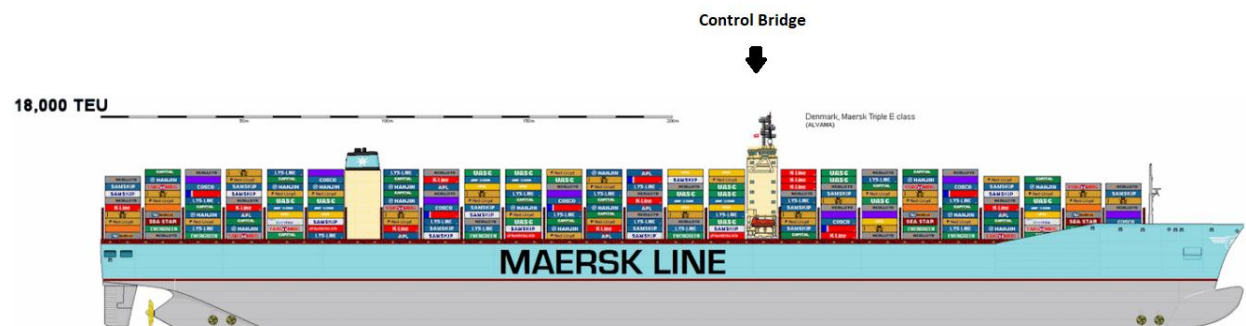


Figure 2 2 - MC Kinney Moller Side schematics

General characteristics	
Type	Container ship
Capacity	18,270 TEU
Deadweight	196,000 DWT
Lightweight	55,000 tonnes (empty)
Length	399.2 m
Beam	58.6 m
Draft	14.5 m
Depth	16 m
Speed	Service: 16 knots Max: 23 knots

Table 2 - MC Kinney Moller technical characteristics

## Panamax - ANL Tongala



Figure 3 - ANL Tongala

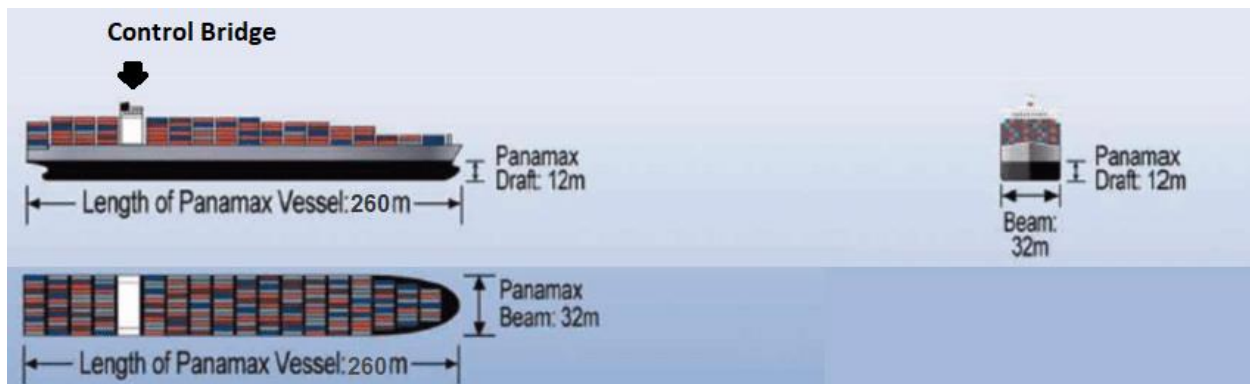


Figure 4 - ANL Tongala schematics

General characteristics	
Type	Container ship
Capacity	4,253 TEU
Deadweight	40,030 DWT
Lightweight	11,450 tonnes (empty)
Length	260.0 m
Beam	32.25 m
Draft	12.60 m
Depth	19.30 m
Speed	Max: 24.5 knots

Table 3 - ANL Tongala technical characteristics



## Feeder - Mv Enforcer

“The MV Enforcer was the first vessel in the successful Volharding Shipyards 750 series, from which JR Shipping operates several vessels. Distinguishing qualities include their high loading capacity, high service speed and large reefer container capacity.” [7]



Figure 3 5 - MV Enforcer

General characteristics	
Type	Container ship
Capacity	750 TEU
Deadweight	9,450 DWT
Lightweight	2,700 tonnes (empty)
Length (overall)	134.65m
Length (between perpendiculars)	125.60m
Beam	21.50 m
Draft	7.00 m
Depth	8.80 m
Speed	Service: 18 knots

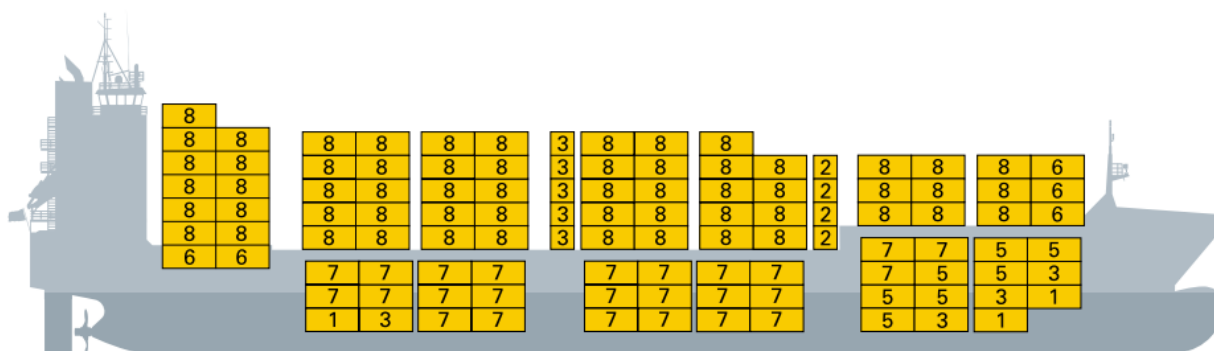


Figure 4 6 - MV Enforcer Side schematics

## Comparing the Ships we Chose

This topic of the report has the objective of comparing the different ships we chose and identify the differentiating characteristics.

	Feeder	Panamax	ULCV
Capacity (TEU)	750	4,253	18,270
Lightweight (tonnes)	2,700	11,450	55,000
Length (m)	134.65	260.00	399.20
Beam (m)	21.50	32.25	58.60
Draft (m)	7.00	12.60	14.50
Depth (m)	8.80	19.30	16.00

Table 4 - Characteristics comparison between ships

In terms of size and load capacity, we can safely say that the bigger the ship, the greater its capacity to carry containers and the heavier the ship itself has to be in order to support all that cargo.

In order to carry more containers, the hull must increase not only in length and beam, but also in depth, since in larger ships the space below deck is used to carry containers as well, especially heavier ones in order to give the vessel more stability. Naturally, the heavier and deeper the ship, the greater the portion of it sunk into the water will be.

When it comes to the bridge location the bigger the ship is, the further forward the bridge is since visibility becomes compromised by the stacks of containers ahead. The MV Enforcer is the smallest of the ships so the bridge is as far back as it can be, but when looking at ANL Tongala it is noticeable that her bridge is further forward and finally looking at Maersk MC Kinney Moller her bridge is even further forward, passing the middle line of the ship.

## Conclusion

As a result of our research, we have discovered different types of ships meant for intermodal container transportation. These ships' sizes are the main differentiating characteristic, and each size is suited to a particular task – with ultra large ships being the most cost-effective transportation solution but with limitation regarding travel to certain ports or canals not prepared to accommodate them. As a solution, medium range ships are useful to traverse these narrow places and, in the case of short-distance travel with light loads, small vessels prove to be the best option.

Across the different ship types, the optimal bridge position can vary. We have learned that placing a control bridge at the bow is generally disregarded because of the damage caused by the frontal impact of the sea waves, however increasingly larger ships must place their control bridge towards this point (but still at midship) in order to assure an obstructed view, as the increasing extension of piled containers starts to be a constraint. In small vessels the bridge is usually located at the stern.

With all this being said, and with the characteristics gathered from three different vessels, we believe we are equipped with the knowledge and data necessary to conduct the calculations related to center of mass and water displacement necessary for the development of the current project.

## References:

- [1] Wikipedia, "Container ship," [Online]. Available: [https://en.wikipedia.org/wiki/Container\\_ship#Size\\_categories](https://en.wikipedia.org/wiki/Container_ship#Size_categories). [Acedido em 20 Janeiro 2022].
- [2] Wikipedia, "Panamax," 1 Abril 2021. [Online]. Available: <https://en.wikipedia.org/wiki/Panamax>. [Acedido em 20 Janeiro 2022].
- [3] F. Frese, "Feeder Vessels and how Feeder Operators collaborate with Forwarders," 6 Janeiro 2020. [Online]. Available: <https://www.container-xchange.com/blog/feeder-vessels/>. [Acedido em 20 Janeiro 2022].
- [4] A. Menon, "Marine Insight," 6 September 2021. [Online]. Available: <https://www.marineinsight.com/naval-architecture/bridge-of-a-ship-design-and-layout/>. [Acedido em 20 January 2022].
- [5] A. Outram, "Why do many large freighters have their bridge located near the stern?," Quora, 8 August 2020. [Online]. Available: <https://www.quora.com/Why-do-many-large-freighters-have-their-bridge-located-near-the-stern-Wouldn-t-the-sight-lines-be-better-at-the-bow>. [Acedido em 20 January 2022].
- [6] E. Magee, "Quora," 28 Abril 2021. [Online]. Available: <https://www.quora.com/If-the-ship-carries-50-000-tons-of-cargo-how-much-is-the-deadweight-of-the-ship>. [Acedido em 19 Janeiro 2022].
- [7] JR Shipping, "MV Enforcer," [Online]. Available: <https://www.jrshipping.com/our-fleet/m-s-enforcer/>. [Acedido em 19 Janeiro 2022].